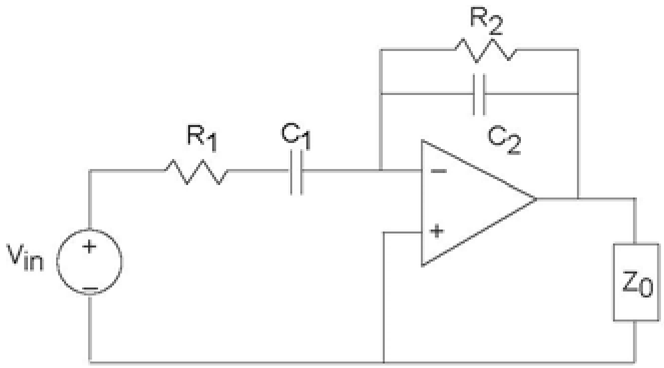


**Figure 6.31**

1. What is the transfer function between the input voltage and the voltage across the transmission line?
2. Find values for the resistors and capacitors so that design goals are met.

**Problem 6.2**: Noise in AM Systems

The signal

$$\hat{s}(t)$$

emerging from an AM communication system consists of two parts: the message signal, *s (t)*, and additive noise. The plot (Figure 6.32) shows the message spectrum *S (f)* and noise power spectrum $P_N(f)$ . The noise power spectrum lies completely within the signal's band, and has a constant value there of

$$\frac{N_0}{2}.$$

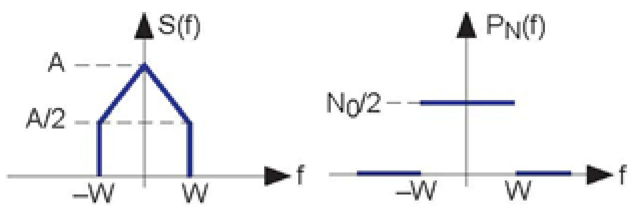


**Figure 6.32**

1. What is the message signal's power? What is the signal-to-noise ratio?
2. Because the power in the message decreases with frequency, the signal-to-noise ratio is not constant within subbands. What is the signal-to-noise ratio in the upper half of the frequency band?
3. A clever 241 student suggests filtering the message before the transmitter modulates it so that the signal spectrum is balanced (constant) across frequency. Realizing that this filtering affects the message signal, the student realizes that the receiver must also compensate for the message to arrive intact. Draw a block diagram of this communication system. How does this system's signal-to-noise ratio compare with that of the usual AM radio?

**Problem 6.3**: Complementary Filters

**Complementary filters** usually have "opposite" filtering characteristics (like a lowpass and a highpass) and have transfer functions that add to one. Mathematically, $H_1(f)$ and $H_2(f)$ are complementary if

$H_1(f) + H_2(f) = 1$